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Gain of the α-NPO dye laser in different solvents

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α-NPO (2-(1-naphthyl)-5-Phenyl oxazole) has been reported so far to work as a laser in only five solvents (Deutsch and Bass 1969, Naboikin *et al* 1969, Furumoto and Ceccon 1970, Maeda and Miyazoe 1971, Turek and Yardley 1971)

In the present study we have observed laser action in 16 solvents and through a study of the gain tried to arrive at the most suitable solvent. The group of solvents studied are hydrocarbons, alcohols, ketones and solvents containing heavy atoms. The gain of the scientillator dye α-NPO in each solvent was measured by the method of Shank and Dienes (1970) using a nitrogen laser built by us

Table 1 gives the wavelength of the peak intensity and the gain of the dye molecule α-NPO per unit kW input pump power at that wavelength in different solvents.

It is found that the solvents in the alcohol group show a gradual variation of gain from lower to higher alcohols Similarly with ketone solvents, it is found that in the ones having longer hydrocarbon chains, α-NPO has higher gain. This suggests that the gain should be larger in the hydrocarbon solvents and experiment also confirms this. The reason for the reduction in gain in the lower alcohols is seemingly due to the loss of energy from the dye to the solvent lattice, which energy is dissipated in the OH vibration of the alcohol molecule.

From the values of gain for group (d) solvents, in Table 1, it is seen that the solvents containing heavy atoms tend to reduce the gain. This is due to the external heavy atom effect (Schafer).

This study suggests that the scientillator dye α-NPO works efficiently as a dye laser in hydrocarbons with cyclohexane being the most suitable. Solvents containing heavy atoms such as carbon tetrachloride give very low gain and are to be avoided.

Table 1. Gain of α-NPO in different solvents (per molecule per unit pump power)

Solvent	wavelength of the peak of the laser emission (nm)	Gain($\times 10^{19}$)	Structure of solvent
A) *Alcohols* :			
1. Methyl	400.0	3.00	CH_3OH
2. Ethyl	399.0	3 53	CH_3CH_2OH
3. Isopropyl	399.5	4.41	$CH_3CH(CH_3)OH$
4. *n*-Butyl	398.5	4.78	$CH_3CH_2CH_2CH_2OH$
5. Isoamyl	400.0	5.11	$CH_3CH_2CH_2CH(CH_3)OH$
6. Caprylic	400.0	6.25	$CH_3CH_2CH_2CH_2CH(C_2H_5)CH_2OH$
B) *Ketones* :			
7. Cyclohexanone	403.0	3 45	$C_6H_{10}O$
8. Acetone	401.0	3.71	CH_3COCH_3
9. Isobutyl Methyl Ketone	400.5	4.42	$CH_3CH_2CH(CH_3)COCH_3$
C) *Hydrocarbons*			
10. Cyclohexane	392 0	7 48	C_6H_{12}
11. Benzene	401 0	6 22	C_6H_6
12 Toluene	400 0	5.80	$C_6H_5CH_3$
13. Xylene	400.5	6.21	$C_6H_4(2CH_3)$
D) *Solvents containing heavy (chlorine) atoms*			
14. 1, 2 Dichloro-ethane	404.0	5 04	CH_2ClCH_2Cl
15. Chloroform	402.0	3.52	$CHCl_3$
16. Carbon Tetrachloride	400.0	0.80	CCl_4

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